



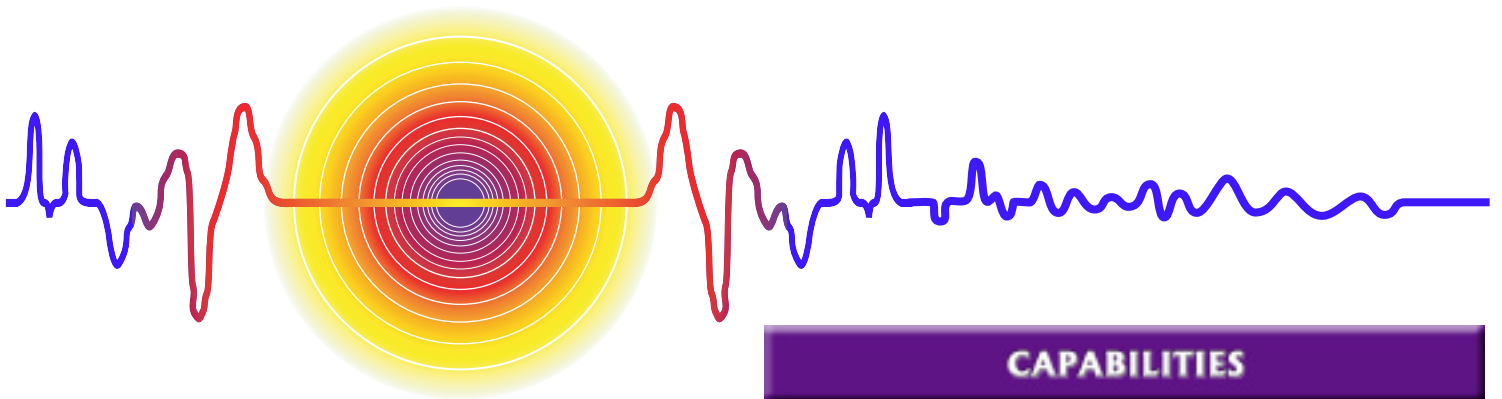
Launch Systems Testbed (LST)

By Raoul Caimi and Ravi Margasahayam

MISSION

The LST mission involves development of potential partners within the space launch industry to:

- ▶ Analyze, design, and test innovative launch structures, equipment, and environment attenuation systems.
- ▶ Serve as a one-stop shop for assessment of advanced structures and materials (composite, inflatable, and nontraditional materials).
- ▶ Establish a one-of-a-kind, scaled, moving, combust-ing, and noncombusting supersonic jet plume test platform to study future launch support structures and vehicles.



CAPABILITIES

VISION

Ensure safety and guarantee launch success by using and continually enhancing the core vibroacoustics capabilities (structural dynamics experts, launch environment database, analysis techniques, and small-scale test facilities) to meet or exceed the reliability, availability, and maintainability of ground structures and launch facilities

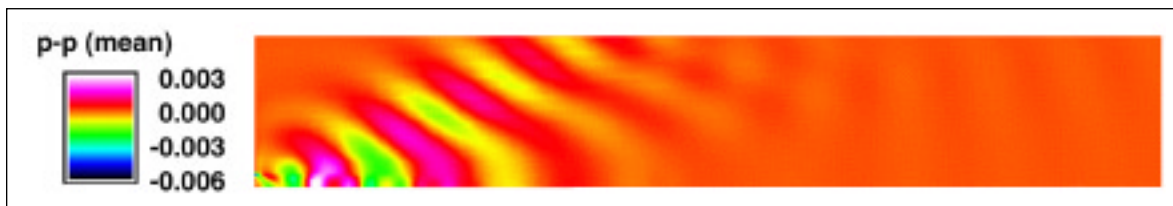
The LST includes:

- ▶ Specialized personnel with structural dynamics backgrounds and launch environment analysis experience.
- ▶ A unique launch environment (acoustics, vibration, etc.) database serving as a knowledge reservoir.
- ▶ Launch environments prediction and structural analysis methodologies to assess nonstationary random data.
- ▶ A one-of-a-kind small-scale rocket lift-off test facility to simulate moving rocket scenarios.

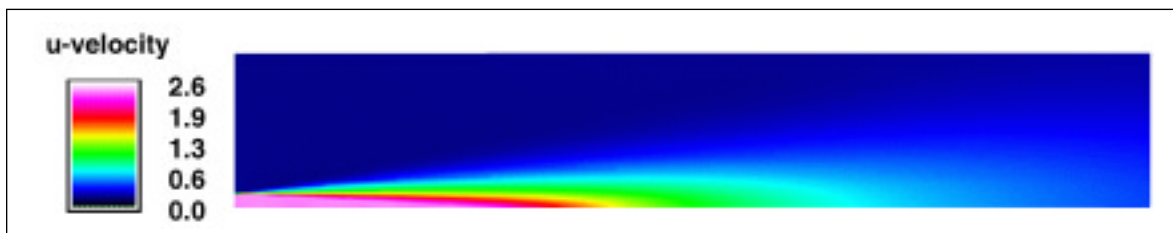
GOALS AND OBJECTIVES

The LST goals support KSC's goals and objectives as follows:

- Ensure sound, safe, and efficient vibroacoustic techniques are in place for evaluating the reliability of structures.
- Enhance core vibroacoustic knowledge for the design/development pad and ground structures.
- Partner with the Government, industry, and academia to enhance the state of the art in rocket noise and vibration.
- Continually increase core capabilities to meet varying customer needs and demands.



Instantaneous pressure contours (from CFD solution) for a perfectly expanded turbulent supersonic jet (Mach 2), indicating Mach wave emission (Ref. Dynacs/KSC, January 2001).



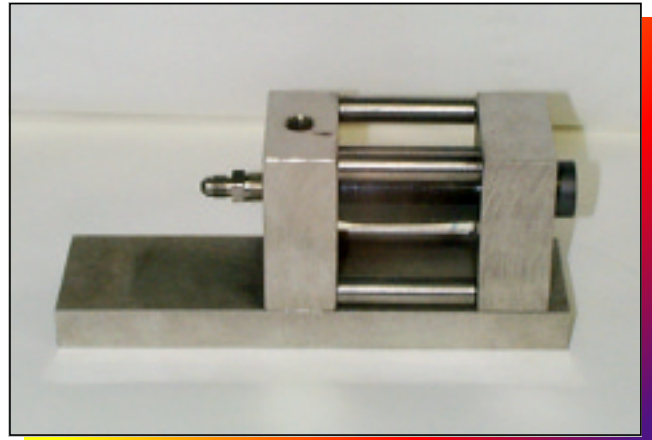
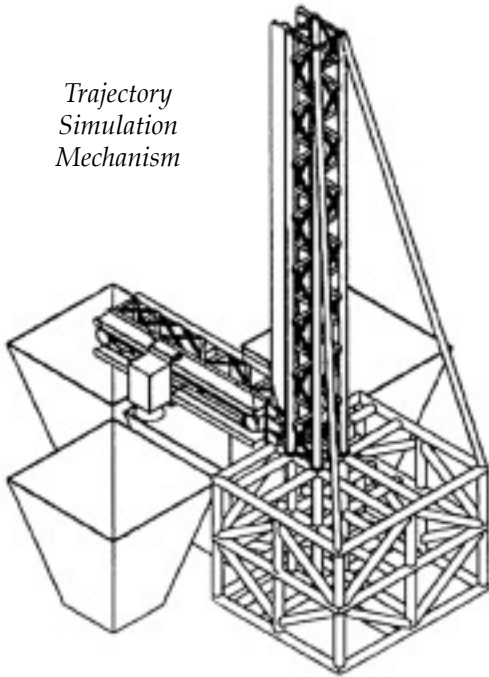
Axial velocity contours (from CFD solution) of a perfectly expanded turbulent supersonic jet (Mach 2), indicating potential core and shear layer mixing (Ref. Dynacs/KSC, January 2001).

TECHNICAL AREAS

The LST projects will focus on the following technical areas:

- Measure/predict vibration response of structures.
- Develop/evaluate acoustic suppression systems.
- Analyze exhaust plumes using Computational Fluid Dynamics (CFD) codes.
- Optimize flame trench configurations.
- Assess/develop rocket scaling methodologies.
- Evaluate use of composite structures for launch pad.
- Predict fatigue life of launch and ground structures.
- Verify cause/effect of hydrogen entrapment.

*Trajectory
Simulation
Mechanism*



Tabletop Rocket

CONSORTIUM

The LST will be organized as an international consortium of partners derived from:

- ▶ NASA Centers (KSC, MSFC, SSC, etc.)
- ▶ Department of Defense
- ▶ U.S. space launch industry (Boeing, Lockheed, etc.)
- ▶ Consultants (Aerospace Corporation, Vibroacoustic Sciences, etc.)
- ▶ National and international universities and academia
- ▶ Commercial product vendors affiliated with the launch space industry

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